Impact of ICT-AI based Courses and Online Internship on Techno–pedagogical Skills and Personalised learning of Pre-service Teachers

Synopsis

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Submitted by

Gulamnavi

Under the Supervision of

Dr. Bajarang Bhushan

Supervisor

Assistant Professor

Department of Foundations of Education, Faculty of Education

Dayalbagh Educational Institute (Deemed to be University)

Dayalbagh, Agra - 282 005

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1.0 Introduction

Technology is crucial in education as it enhances access to resources, facilitates personalized learning, promotes engagement, supports collaboration, and enables efficient teaching practices. For Pre-service Teachers, it offers an opportunity to move beyond traditional methods, adapting to evolving learning needs with dynamic, flexible approaches. Information and Communication Technology (ICT) refers to the use of technology to handle information and facilitate communication through devices and software. ICT encompasses a wide range of technologies, including computers, the internet, digital devices, and multimedia tools, which are used to store, retrieve, transmit, and manipulate data. In recent decades, ICT has revolutionized many sectors, particularly education, where it plays a crucial role in enhancing learning experiences, increasing access to knowledge, and facilitating communication (Anderson, 2008). The integration of ICT in education enables teachers and students to engage with resources and platforms that promote active learning, collaboration, and innovation. With the advent of online learning platforms, digital textbooks, and interactive multimedia, ICT has transformed traditional classroom environments into more dynamic and flexible spaces (Oblinger, 2005). The increased accessibility of the internet and digital resources has allowed education to be more inclusive, providing students with opportunities to learn beyond the confines of physical classrooms (Ally, 2008). Moreover, ICT offers significant potential to improve the quality of education by enhancing pedagogical practices. Through the use of digital tools, teachers can create more engaging and Personalised learning experiences, catering to the individual needs of students (Jonassen, 2010). The integration of ICT also facilitates better communication between educators and students, as well as among peers, fostering collaboration and knowledge sharing (Trentin, 2014). As ICT continues to evolve, its role in education becomes even more critical, enabling teachers to use data-driven insights to personalise instruction, adapt learning materials, and provide real-time feedback (Hattie, 2009). The effective use of ICT is not only important for improving academic outcomes but also for equipping students with essential digital literacy skills necessary for success in the modern world. National Education Policy (NEP 2020, p.56) and the AICTE's Approval Process Handbook (APH, 2018 p.12): both emphasize the importance of ICT in

transforming the education system. The National Educational Policy stresses the integration of technology at all levels of education to enhance learning outcomes and bridge gaps in access to education. It advocates for using digital platforms, online resources, and e-learning tools to improve teaching, learning, and assessment. The policy also focuses on digital literacy, aiming to equip all students with the skills needed to navigate a technology-driven world. It encourages online and blended learning, especially after the pandemic, emphasizing flexible learning paths such as virtual classrooms and online Courses. Additionally, the NEP highlights the use of technology for pedagogical innovation, where teachers are encouraged to incorporate digital tools to make learning more engaging and effective. It also stresses the importance of building robust ICT infrastructure in educational institutions, particularly in remote areas, to ensure access to high-speed internet, digital devices, and educational software. The NEP, 2020 further calls (NEP 2020, P.59) for the establishment of virtual laboratories and simulations for practical learning and supports the development of e-content and open educational resources (OER) to ensure nationwide accessibility.

Artificial Intelligence (AI) has emerged as a transformative technology in the field of education, providing innovative ways to enhance learning experiences and improve educational outcomes. AI in education includes the use of algorithms, machine learning, and data-driven systems to personalise learning, assess student performance, and assist teachers in delivering tailored educational content (Luckin et al., 2016). With the rapid development of AI technologies, educational institutions have started integrating AI-driven tools such as virtual assistants, intelligent tutoring systems, and adaptive learning platforms into teaching and learning processes (Baker et al., 2019). One of the key contributions of AI is Personalised learning, where AI algorithms analyse students' learning patterns and adapt the curriculum to meet their individual needs. By providing real-time feedback, AI systems can offer learners immediate insights into their strengths and areas for improvement, allowing them to progress at their own pace (Guszcza et al., 2017). AI also supports teachers by automating administrative tasks, allowing educators to focus on providing more meaningful interactions with students (Holmes et al., 2019). Moreover, AI-powered technologies, such as chatbots and natural language processing systems, help facilitate student engagement and offer immediate assistance outside of the classroom environment (Almalki & Aziz, 2020). As AI continues to evolve, it holds the potential to reshape the future of

education by enhancing accessibility, improving learning outcomes, and addressing challenges related to student diversity and inclusion (Feldstein et al., 2017).

The (NCTE, 2009, p.11) emphasizes the importance of internships as a key component of teacher education, serving as a practical experience for Pre-service Teachers to apply theoretical knowledge in real classroom settings. This period is critical for developing classroom management skills, teaching techniques, and the ability to work with diverse student populations. Internship means bridging the gap between theory and practice. During the internship, each trainee is expected to be supervised by both a mentor teacher at the school and a supervisor from the teacher education institution. This dual supervision ensures that the trainee receives constructive feedback on their teaching performance, as well as guidance on their personal and professional development. The internship is assessed not only through observation but also by evaluating the trainee's teaching practice, ability to engage with students, and reflect on their experiences. NCTE recommends a comprehensive assessment, involving feedback from mentors, peers, and institutions themselves. Regarding the use of technology in teacher education, the (NCTE, 2009, p.14) stresses the need for teacher education programs to integrate technology into the curriculum. Future teachers should be trained to effectively use technology as a teaching tool, whether for lesson planning, delivering content, or engaging with students. The document emphasizes that ICT should be incorporated into the curriculum, and teacher trainees must be familiarized with various technological tools such as smart boards, online resources, educational software, and digital platforms to enhance their teaching practices. The NCTE guidelines suggest that technology skills should extend beyond the mere use of digital tools to also include the ability to evaluate the effectiveness of technology in the classroom. Trainees should also be trained to use technology for their professional development, such as participating in online Courses, webinars, and collaborative learning platforms. Teacher education programs are encouraged to use technology in their own teaching to model the kind of integration they expect from their trainees, ensuring access to computers, the internet, and educational software for both teaching and learning purposes.

Online teaching has become an essential component of modern education, offering a flexible and accessible approach to learning. With the rise of digital technologies and the widespread use of the internet, online teaching has enabled educators to reach students beyond the traditional classroom

setting, providing opportunities for self-paced learning and greater educational accessibility (Moore, 2013). Online education platforms, such as learning management systems (LMS), video conferencing tools, and virtual classrooms, allow for dynamic interactions between instructors and students, fostering collaboration and engagement in digital environments (Bates, 2015). One of the primary advantages of online teaching is its ability to cater to diverse learning styles and needs. It enables students to access a variety of resources, including videos, podcasts, eBooks, and interactive simulations, making learning more engaging and tailored to individual preferences (Anderson, 2008). Additionally, the use of online assessments and real-time feedback allows educators to monitor student progress and make data-driven decisions about instruction, improving learning outcomes (Selwyn, 2016). Despite its advantages, online teaching also presents challenges, including issues related to student motivation, engagement, and the digital divide (Garrison & Anderson, 2003). However, with proper instructional design and the integration of effective technologies, online teaching can offer a highly effective and inclusive learning experience (Moore & Kearsley, 2012). As the global shift toward online learning continues, it is clear that online teaching will remain a vital aspect of education, providing students with the skills and knowledge they need for success in the digital age.

In contemporary education, the integration of Information and Communication Technology (ICT), Artificial Intelligence (AI), and online teaching has significantly reshaped the learning experience. These technologies are playing a pivotal role in enhancing both teaching and learning, offering innovative tools that promote communication, collaboration, and resource access. According to Anderson and Hira (2004), ICT has empowered educators and students to engage with interactive multimedia, learning management systems, and remote platforms, effectively supporting distance education. The shift toward digital learning environments facilitated by ICT has also led to the growth of personalized learning, where students can tailor their educational experiences to their individual needs and pace (Kukulska-Hulme, 2012). This transformation enables more flexible, learner-centered approaches that adapt to diverse learning styles, fostering greater student autonomy and engagement. In parallel, Artificial Intelligence has further enhanced the capabilities of educational technologies by utilizing algorithms and machine learning to analyse learning patterns and provide tailored instruction (Siemens, 2013). AI-driven systems, such as intelligent tutoring systems and virtual teaching assistants,

not only offer personalized feedback but also support educators by automating administrative tasks, thereby improving efficiency (Koedinger et al., 2015). Moreover, AI's data-driven insights into student performance allow educators to better meet individual learning needs, improving outcomes and supporting a more adaptive educational environment (Chen et al., 2020). The rise of online teaching platforms, supported by ICT and AI, has revolutionized education by providing flexible and accessible learning opportunities beyond the traditional classroom setting. These platforms enable instructors to design engaging, multimedia-rich Courses and incorporate interactive activities that foster a student-cantered learning environment (Palloff & Pratt, 2013). By leveraging AI algorithms to track student progress, online teaching systems can personalize content delivery to ensure each student receives appropriate instruction, adapting to their unique learning needs (Laurillard, 2012). Together, the integration of ICT, AI, and online teaching offers unparalleled opportunities to enhance the learning experience. These technologies provide greater flexibility, personalized learning paths, and increased engagement, making education more inclusive and accessible. They not only support current educational practices but also hold the potential to address future challenges, offering scalable solutions that can improve learning outcomes for students worldwide (VanLehn, 2011).

In the digital era, Techno-pedagogical skills have become essential competencies for educators. These skills involve the integration of technological knowledge with pedagogical strategies to enhance teaching and learning (Koehler & Mishra, 2009). As the educational landscape continues to evolve with the adoption of Information and Communication Technology (ICT), it is imperative for educators to effectively utilize digital tools while maintaining sound pedagogical practices (Mishra & Koehler, 2006). By blending technology with pedagogy, teachers can create dynamic and engaging learning environments that cater to diverse student needs (Gulbahar & Guven, 2008). Research indicates that teachers with strong techno- pedagogical skills are better equipped to implement active learning strategies and leverage digital platforms for communication, collaboration, and assessment (Harris, Mishra, & Koehler, 2009). These competencies also foster personalized learning, allowing technology to adapt content and teaching methods to meet the individual needs of students (Voogt & Roblin, 2012). Beyond technological proficiency, techno-pedagogical skills include the critical ability to evaluate the pedagogical effectiveness of digital tools, ensuring that technology enhances learning objectives and

improves the overall educational experience (Erdoğan, 2016). The development of techno-pedagogical skills is not only essential for educators to navigate the complexities of the digital education landscape, but also vital for creating meaningful and effective learning experiences in today's technology-driven world. As blended and online learning environments become increasingly prevalent, educators are tasked with the challenge of seamlessly integrating digital tools with traditional teaching methods. This integration requires a deep understanding of both pedagogy and technology to ensure that digital tools enhance, rather than hinder, the learning process (Mishra & Koehler, 2006). As technology continues to advance, the need for educators to develop techno-pedagogical knowledge becomes even more critical. Teachers must stay current with emerging technologies, platforms, and tools, all while maintaining a focus on pedagogical practices that promote student engagement and active learning. Furthermore, the ability to critically evaluate and adapt digital resources is crucial, ensuring that these tools align with educational goals and learning outcomes. For educators, the ability to blend technology and teaching strategies effectively not only supports individualized learning but also fosters collaborative problem-solving and critical thinking among students (Chai, Koh, & Tsai, 2013). As we move further into the 21st century, these skills will play an essential role in shaping technologically literate learners who are prepared to thrive in an interconnected, problem-solving focused society. Ultimately, the purposeful use of technology in education has the potential to significantly enhance both the teaching and learning experience.

Personalized learning is a transformative educational approach that tailors learning experiences to meet the unique needs, skills, and interests of each student. Unlike traditional educational models, which often follow a one-size-fits-all approach, personalized learning empowers students to progress at their own pace, select their learning paths, and receive customized instruction and support based on their individual abilities (Pane, Steiner, Baird, & Hamilton, 2015). This student-centered model emphasizes flexibility in the learning process, enabling educators to adapt content, activities, and assessments to suit the strengths and weaknesses of each learner (Puentedura, 2014). Technology plays a pivotal role in facilitating personalized learning. Tools such as Learning Management Systems (LMS), adaptive learning technologies, and data analytics allow teachers to track student progress and provide real-time feedback. These technologies enable students to access learning materials in various formats—such as

videos, simulations, and eBooks—and work at their own pace, fostering a more individualized learning experience (Edwards, 2016). This approach helps to create a dynamic, interactive environment where students are engaged and motivated to take ownership of their learning process. Personalized learning not only focuses on improving academic outcomes but also encourages the development of important skills such as self-regulation and motivation. By giving students more control over their learning, it promotes deeper engagement, as they feel more invested in their educational journey (Walkington, 2013). This approach recognizes that each student learns differently, and as such, offers tailored support and learning opportunities that meet diverse needs, leading to greater academic success and overall well-being (Koller, 2013). Moreover, personalized learning holds the potential to enhance equity in education by providing all students, regardless of their background or ability, with the opportunity to succeed. By addressing individual learning needs and ensuring that every student has the resources they need to thrive, personalized learning offers a more inclusive and supportive educational experience for all.

2.0 Emergence

Technological advancements and policy shifts are reshaping the educational landscape, with the increasing adoption of ICT and AI pushing classrooms toward becoming more technology-enhanced. This shift necessitates that teachers incorporate digital tools into their teaching methods. The National Education Policy (NEP 2020, p.56) emphasizes the integration of technology in education, focusing on skill development and creating Personalised learning opportunities for students. This aligns with the growing need for teacher education programs to include ICT-AI-based Courses that help Pre-service Teachers acquire essential skills for the digital age. The transition to online and hybrid learning environments, which was accelerated by the COVID-19 pandemic, has underscored the urgent need for teachers to master digital classroom management and virtual teaching tools. The study highlights online internship as an innovative approach to teacher training, emphasizing how these experiences, integrated with ICT and AI, can help Pre-service Teachers develop key skills required for teaching in a digital-first world. Additionally, Personalised learning, which tailors' educational experiences to individual students' needs, has emerged as a critical focus. ICT and AI tools can significantly enhance Personalised learning by adapting lessons to students' varying paces and abilities (De Leon-Enanoza, 2023).

In the 21st century, technology plays a transformative role in education, shaping the way teaching and

learning are conducted. It offers numerous opportunities to improve educational experiences, enhance learning outcomes, and support both teachers and students in navigating the digital landscape. The Dayalbagh Educational Institute (DEI) plays a essential role in this context through its Teacher Education Program, which integrates ICT-AI-based Courses and online internships into teacher preparation. This initiative offers Pre-service Teachers practical experience in digital classrooms and helps them design and implement Personalised learning experiences. The study will explore how DEI's program prepares future educators to meet the demands of a tech-driven educational environment. By focusing on this approach, the research aims to understand how will ICT-AI-based Courses and online internship contribute to developing the necessary skills such as lesson planning with technology, using Al for assessment, or integrating adaptive learning tools. for teaching in technology-enhanced classrooms. This research will provide valuable insights into how teacher preparation programs that integrate ICT-AI resources and online internship can better equip educators for the challenges and opportunities presented by modern educational environments. It is essential for understanding how technology can be effectively integrated into teacher training and how it contributes to the development of skilled educators in the digital age. The researcher likely chose the topic to explore the intersection of digital technology, teacher preparation, and Personalised learning.

DEI's online internship program, which integrates ICT-AI tools, provides an opportunity to investigate how will these technologies influence Pre-service Teachers' techno- pedagogical skills—combining teaching techniques with technology. The program's emphasis on digital resources, such as Google Meet, Google Classroom, Zoom, and educational apps, that helps Pre-service Teachers learn to integrate technology into lesson plans effectively. By studying the impact of ICT-AI Courses on the development of techno-pedagogical skills, the researcher aims to understand how these tools will provide help for Pre-service Teachers. Blend curriculum and pedagogy with technology to engage students better, manage classrooms, and enhance learning experiences. Additionally, the concept of Personalised learning, which is emphasized in DEI's curriculum through differentiated instruction, is supported by ICT-AI tools. These technologies enable Pre- service Teachers to cater to diverse learning needs, adapting lessons and activities to suit various student paces and abilities. The researcher is also interested to know how will online internship experiences shape these skills, given that DEI's program is

conducted entirely online. This format offers a unique opportunity to examine how virtual teaching environments, supported by ICT and AI tools, impact the development of teaching skills, collaboration, and professional growth. In essence, the researcher is likely aiming to understand how combining online internship with ICT-AI resources can enhance the preparation of Pre-service Teachers, equipping them with the necessary skills to teach effectively in modern, tech-driven classrooms while focusing on personalised, student- centred learning.

3.0 Justification

The National Education Policy (NEP 2020, p.56) emphasizes the integration of ICT and AI into education to foster skill development, Personalised learning, and more effective assessment methods. This research directly aligns with that policy by examining how ICT-AI-based Courses and Online internship helps Pre-service Teachers develop the Techno-pedagogical skills necessary for implementing Personalised learning in classrooms. This study focuses on the critical intersection of technology and pedagogy, particularly in developing techno-pedagogical skills among Pre-service Teachers. These skills are essential for integrating digital tools into teaching practices to enhance student engagement, classroom management, and overall learning outcomes. By exploring how ICT-AI Courses contribute to these skills, the research aims to prepare teachers for the digital classrooms of the future. The shift toward Personalised learning is a significant trend in education, as it allows teachers to tailor instruction to meet the diverse needs of individual students. ICT and AI tools play a essential role in facilitating Personalised learning by providing adaptive technologies that allow teachers to address different learning paces and styles. This research explores how Pre-service Teachers can leverage these tools to create customized learning experiences, ultimately ensuring more inclusive and effective teaching practices. Online internship, which gained prominence during the COVID-19 pandemic, offer flexible and accessible opportunities for Pre-service Teachers to gain practical experience in digital and hybrid learning environments. This study aims to evaluate how online internship, integrated with ICT and AI tools, contribute to the development of teaching skills, collaboration, and professional growth. While there is significant research on the individual use of ICT and AI in education, limited research exists on their combined impact in the context of online internship and teacher preparation which are discussed below. This study seeks to fill that gap by examining how ICT-AI-based Courses and Online

internship together influence the Techno-pedagogical skills and Personalised learning capabilities of Pre-service Teachers. As classrooms become increasingly digital, it is essential to prepare Pre-service Teachers with the skills necessary to integrate technology effectively into their teaching practices. This research aims to explore how integrating ICT and AI tools into both coursework and internship prepares Pre-service Teachers to teach effectively in a technology-driven educational environment.

In a research Ghavifekr and Wan Rosdy (2015) concluded that successful ICT implementation in schools' hinges on an effective initial stage, ensuring that both teachers and students maximize its potential. They highlight the significant benefits of ICT integration for educational success. However, the study lacks focus on the long-term impact of ICT on teaching practices and student outcomes. Nibedita Boruah, (2022) emphasizes the role of ICT in expanding access, enhancing the relevance of education to the digital workplace, and improving educational quality by making teaching and learning more interactive and real-world connected. However, the study does not specifically address the impact of ICT on pre- service internees or teacher training, leaving a gap in this area. Timotheou et al. (2023) reviewed the impact of digital technologies on education, highlighting factors such as infrastructure, leadership, and teacher readiness that influence schools' digital transformation. While emphasizing the broader process of digitalization, the study does not specifically address the effects of these transformations on individual learners or particular educational levels, leaving a gap in this area. Anastasopoulou, Tsagri, and colleagues (2024) explored ICT's transformative potential in education, emphasizing its role in creating an inclusive, equitable, and innovative system for digital-age success. While the study highlights ICT's positive impact on learning opportunities, it lacks examination of the long-term effects on academic performance and digital skill development, which could provide further insights into its effectiveness. Humble and Mozelius (2019) discuss AI's potential to ease teachers' routine tasks and support online learning, emphasizing its ability to offer mass individualization and 24/7 feedback. They envision a future where AI handles technical tasks, allowing teachers to focus on human-centred activities. However, the study lacks a detailed exploration of the challenges and practical implementation of AIED in real classroom settings. Benbya, Davenport, and Pachidi (2020) explore the evolving impact of AI on organizations, stressing the need for businesses to develop AI applications that create economic value and reshape work. They highlight the importance of upskilling and retraining the

workforce. However, the study lacks detailed strategies for AI integration and addressing resistance to change in organizations.

Naz (2024) investigates the correlation between AI use and school adjustment among secondary school students, finding a moderate positive relationship—higher AI use leads to better school adjustment. However, the study lacks exploration of specific AI tools used, the factors influencing this correlation, and the long-term effects on students' overall development. Mantha (2024) discusses the transformative potential of AI in higher education in India, emphasizing its ability to personalise learning and boost participation. She advocates for ethical use and continued research to unlock AI's full potential. However, the study lacks detailed exploration of AI implementation challenges, its impact on faculty, and regional disparities in access. Sharma and Chahal (2022) highlight the positive impact of internship programs in teacher education, fostering personality development, problem-solving skills, and content mastery in B.Ed. interns. They also emphasize socialization through interactions with school stakeholders and community involvement. However, the study lacks exploration of challenges faced by interns and the long-term impact of these internships on teaching effectiveness. Ugalingan, Edjan, and Valdez (2021) explore the online internship experiences of pre-service ESL teachers in the Philippines, identifying challenges such as interaction difficulties, lack of self-confidence, and technical issues. They also highlight opportunities like fostering learner autonomy and collaborating with supervisors. However, the study lacks insight into the long-term effects of these experiences and strategies to overcome challenges. Reyes (2023) examines the challenges faced by pre-service English teachers during their online teaching internship amid the COVID-19 pandemic. Participants found the experience difficult, as they struggled to adapt to online teaching, deviating from their expectations of traditional practicum. The study lacks focus on how these challenges were overcome and the long-term effects on teaching preparedness. De Leon-Enanoza, Quinco- Cadosales, and De Leon Abao (2023) explore the opportunities and challenges of online student internships during the COVID-19 pandemic. They suggest that teacher education institutions can enhance opportunities and address challenges by revising internship program modalities. However, the study lacks specific recommendations on practical changes to internship structures and the long-term impact on interns.

Thakur (2025) discusses the importance of Techno-pedagogical Skills in higher education, emphasizing

that technology alone cannot replace effective teaching. The study highlights the role of skilled instructors in achieving successful electronic learning outcomes. However, it lacks detailed exploration of strategies for developing these skills and overcoming implementation challenges. Asad, Aftab, Sherwani, and colleagues (2021) review the importance of Techno-pedagogical Skills for effective 21st-century digital classrooms, arguing that innovation alone cannot replace quality education. They emphasize the need for technical education skills to achieve optimal electronic learning outcomes. However, the study lacks practical strategies for enhancing these skills in educators. Rao and Jalajakshi (2021) stress the importance of integrating technology and pedagogy, creating "techno-pedagogues" for 21st-century classrooms. They highlight the challenges in developing these skills and call for a collective effort from all stakeholders. However, the study lacks specific solutions or frameworks for overcoming these challenges in teacher development. Bhadana (2023) emphasizes the importance of developing Techno-pedagogical Skills in teachers to align with NEP 2020 and achieve the G20 vision. While recognizing the challenges, she calls for collective efforts to enhance these skills. However, the study lacks practical strategies for addressing these challenges and fostering collaboration among stakeholders. Walkington and Bernacki (2020) suggest that Personalised learning (PL) should focus on researcher- practitioner partnerships, incorporating learning theory, teacher insights, and contextual differences. They emphasize collaborative, design-based research and rich classroom observation. However, the study lacks practical examples or detailed frameworks for implementing these approaches in diverse educational settings. Gunawardena, Beshop, and Aviruppola (2024) apply complexity theory to Personalised learning, highlighting how the interaction of physical environments, student-teacher relationships, and learning materials shapes effective learning. They argue that understanding these complexities can improve educational design. However, the study lacks detailed practical strategies for applying complexity theory in real-world classrooms and evaluating its effectiveness. Dumont and Ready (2023) explore how Personalised learning, when executed well, aligns with equity goals by ensuring all students acquire essential competencies for active participation in society. They emphasize its potential to foster educational equity. However, the study lacks practical frameworks for ensuring consistent high-quality implementation across diverse educational contexts, which is crucial for achieving this vision. Pawar (2023) discusses AI’s potential to revolutionize Personalised learning and

educational technology, stressing the importance of ethical considerations and ongoing research in its implementation. While AI promises significant educational benefits, the study highlights the need for careful integration to avoid drawbacks. However, it lacks specific guidelines for responsible AI implementation in diverse educational settings.

The impact of ICT-AI-based courses and online internships on the Techno-pedagogical Skills and Personalised learning of Pre-service Teachers is an emerging area of research that highlights the evolving relationship between technology and education. The transition to online learning, accelerated by the COVID-19 pandemic, has provided both challenges and opportunities for teacher education. For instance, while the integration of technology in teaching, particularly through online internships, offers teachers the chance to enhance their pedagogical skills, it also brings forth challenges such as technical difficulties, lack of self- confidence in online teaching, and issues related to interaction in virtual environments (Ugalingan, Edjan, & Valdez, 2021). Additionally, the need for Techno-pedagogical Skills has been emphasized, as these are critical for effectively combining pedagogy with technology to improve teaching outcomes (Thakur, 2015). Several studies have recognized the transformative role of ICT in education, offering new opportunities for enhancing the learning experience and improving accessibility and engagement (Garcia-Penalvo, 2020). However, these advancements are not without their challenges. Many studies identify a gap in the long-term effects of ICT on teaching practices and student outcomes, particularly regarding Pre-service Teachers' preparedness and the effectiveness of online internships (Ghavifekr & Wan Rosdy, 2015; Reyes, 2023). While ICT has been shown to improve teaching and learning, there is a lack of research addressing how specific ICT tools, such as AI, can be effectively integrated into teacher training programs to improve Personalised learning and enhance the development of Techno-pedagogical Skills (Nibedita Boruah, 2022; Pawar, 2023).

Furthermore, studies on AI-enhanced learning highlight its potential for Personalised learning and educational technology (Pawar, 2023; Alrawashdeh et al., 2024). However, these studies point to the need for responsible AI implementation, with ethical considerations taking center stage to ensure that AI's benefits are maximized while mitigating potential drawbacks. Despite the growing interest in AI's potential, there remains a lack of guidelines or frameworks for the integration of AI tools in pre-service teacher education programs, leaving a gap in practical strategies for the implementation of AI to enhance

Techno-pedagogical Skills (Humble & Mozelius, 2019; Benbya et al., 2020). Similarly, research on Personalised learning (PL) suggests that it can be more effective than traditional curricula by tailoring learning experiences to students' individual needs (Ghaida et al., 2024). However, there is a noticeable gap in understanding how Personalised learning, when integrated with ICT and AI tools, can be effectively utilized in pre-service teacher training. This gap is compounded by the lack of practical examples or detailed frameworks for implementing PL strategies in diverse educational settings (Dumont & Ready, 2023; Walkington & Bernacki, 2020). In conclusion, while ICT, AI, and online internships offer significant potential for improving the Techno- pedagogical Skills of Pre-service Teachers and promoting Personalised learning, there are clear gaps in the literature. These include the lack of long-term studies on the effects of these technologies on teaching practices, the absence of specific guidelines for the ethical integration of AI, and the need for practical frameworks to help teacher educators implement these tools effectively. Addressing these gaps will be crucial in enhancing the overall quality of teacher education and ensuring that Pre-service Teachers are fully prepared to navigate the digital age of education. The researcher reviewed the studies but no study specifically focused on the impact of ICT-AI based courses online internship for Pre-service Teachers was found. This highlights a gap in the existing literature, indicating the need for further research in this area.

4.0 Statement of the Problem

"Impact of ICT-AI based Courses and Online Internship on Techno-Pedagogical Skills and Personalised learning of Pre-service Teachers."

5.0 Variables of the Study

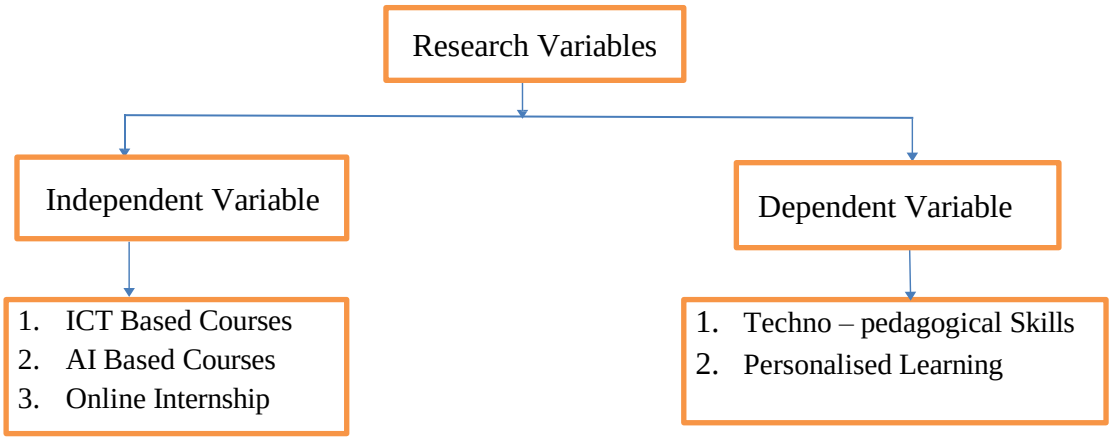

Figure 1 Research Variables

6.0 Definitions of the terms used in the Study

6.1 Information and Communication Technologies (ICT) Course

According to Williams (2005), an Information and Communication Technologies (ICT) course is an academic program aimed at equipping students with the necessary knowledge and skills to effectively utilize technology for managing, processing, and communicating information. ICT encompasses a broad spectrum of technologies, including computing, telecommunications, and networking. The curriculum of an ICT course typically includes various subjects such as computer systems, software development, data management, and cybersecurity, all of which are essential for preparing students to meet the demands of a technology-driven world.

Operational Definition

The ICT for School and Teaching Learning Management course at Dayalbagh Educational Institute equips Pre-service Teachers with the skills to integrate Information and Communication Technology (ICT) into teaching. It focuses on using Learning Management Systems (LMS), multimedia, and AI technologies for lesson planning, content delivery, assessment, and student engagement, effective pedagogical practices.

6.2 Artificial Intelligent (AI) Course

An Artificial Intelligence (AI) course is an academic program that emphasizes the study and application of algorithms, models, and systems designed to enable machines to perform tasks traditionally requiring human intelligence. According to Russell and Norvig (2021), AI courses typically cover a range of topics such as machine learning, natural language processing, robotics, neural networks, computer vision, and cognitive computing. The primary objective of these courses is to provide students with both the theoretical foundation and practical skills necessary to develop and implement intelligent systems across various sectors, including healthcare, finance, robotics, and data analysis.

Operational Definition

At Dayalbagh Educational Institute, AI-based Courses refer to specialized programs that focus on teaching Pre-service Teachers how to incorporate Artificial Intelligence (AI) technologies into the educational process. These Courses emphasize the use of AI-driven tools such as intelligent tutoring, adaptive learning platforms, and AI-based assessment tools. The aim is to prepare Pre-service Teachers

with the knowledge and skills necessary to use AI to personalize learning experiences, assess student progress, and enhance instructional effectiveness, fostering a more interactive and individualized learning environment.

6.3 Online Internship

According to Lefebvre & Manthos (2020), an Online Internship Programme is defined as: "A structured, remote, work-based learning experience in which interns engage in real-world tasks and responsibilities within a professional setting, facilitated through digital tools. The internship is designed to enhance students' professional competencies by providing opportunities for virtual collaboration, skills development, and exposure to industry practices. Interns interact with supervisors and teams via online platforms, receiving guidance, feedback, and performance evaluation, all without the requirement for physical presence in a traditional workplace. This programme aims to integrate theoretical knowledge with practical experience while fostering digital literacy, self-regulation, and communication skills."

Operational Definition

An Online internship in the context of this research refers to a virtual, hands-on teaching experience where Pre-service Teachers engage in practical teaching activities through digital platforms. During the internship, Pre-service Teachers apply their knowledge of ICT and AI technologies in real-world online or hybrid classroom settings. They are responsible for designing lessons, delivering content, assessing students, and providing feedback using online tools and learning management systems. The internship allows Pre-service Teachers to practice and refine their techno-pedagogical skills while promoting personalized learning through digital technologies in a supervised online environment.

6.4 Techno – pedagogical Skills

Koehler et al., 2013 "Techno-pedagogical skills refer to the ability to design and deliver lessons that integrate technology to enhance teaching and learning processes. Teachers must understand how to select and use technological tools that support specific pedagogical strategies to meet learners' needs and goals."

Operational Definition

Techno-pedagogical skills in this research are defined as the ability of Pre-service Teachers to effectively integrate technology with pedagogical principles in classroom instruction. This includes

using digital tools (Learning Management Systems, educational apps, platforms) to enhance teaching and learning, adapt content based on student needs, and evaluate student progress using technology. These skills also involve the ability to critically assess the pedagogical effectiveness of these tools and create engaging, inclusive, and student-centered learning environments. The development of techno-pedagogical skills is measured by the Pre- service Teachers' ability to utilize ICT and AI tools for content delivery, student assessment, interaction, and feedback.

6.5 Personalised learning

Barrett, 2013 "Personalised learning is a dynamic educational approach in which students have some control over the time, place, path, and pace of their learning. It involves adaptive learning techniques and tools that allow teachers to design individualized learning experiences that are responsive to each student's strengths, needs, and preferences."

Operational Definition

Personalized learning refers to the educational approach where Pre-service Teachers use ICT and AI tools to tailor learning experiences according to the individual needs, preferences, abilities, and interests of each student. In this research, it is operationalized as the ability of Pre-service Teachers to design lessons that allow for self-paced learning, provide individualized instruction, and adapt learning pathways for diverse students. Personalized learning is facilitated through the use of adaptive learning technologies, on student performance, and interactive platforms that allow students to learn in varied formats and progress at their own pace. The research will assess how well Pre-service Teachers can apply personalized learning strategies during their online internship.

7.0 Research Questions

- What is the Impact of ICT based Course on Techno- pedagogical Skills of Pre-service Teachers?
- What is the Impact of ICT based Course on Personalised learning of Pre-service Teachers?
- What is the Impact of AI based Course on the Techno-pedagogical Skills of Pre-service Teachers?
- What is the Impact of AI based Course on the Personalised learning of Pre-service Teachers?
- What is the Impact of Online Internship on the Techno-pedagogical Skills of Pre- service Teachers?
- What is the Impact of Online Internship on the Personalised learning of Pre-service Teachers?

8.0 Objectives of the Study

- To study the Impact of ICT based Course on Techno- pedagogical Skills of Pre-service Teachers
- To study the Impact of ICT based Course on Personalised learning of Pre-service Teachers
- To study the Impact of AI based Course on the Techno-pedagogical Skills of Pre- service Teachers
- To study the Impact of AI based Course on the Personalised learning of Pre-service Teachers
- To study the Impact of Online Internship on the Techno-pedagogical Skills of Pre- service Teachers
- To study the Impact of Online Internship on the Personalised learning of Pre-service Teachers

9.0 Hypothesis of The Study

- There will be significant Impact of ICT based Course on the Techno-pedagogical Skills of Pre-service Teachers.
- There will be significant Impact of ICT based Course on the Personalised learning of Pre-service Teachers.
- There will be significant Impact of AI based Course on the Techno-pedagogical Skills of Pre-service Teachers.
- There will be significant Impact of AI based Course on the Personalised learning of Pre-service Teachers.
- There will be significant Impact of Online Internship on the Techno-pedagogical Skills of Pre-service Teachers.
- There will be significant Impact of Online Internship on the Personalised learning of Pre-service Teachers.

10.0 Research Design Process

A research design serves as a guide or strategy for carrying out a study. It describes how to gather, examine, and interpret data in order to respond to the research questions. The research design helps researchers come to valid and trustworthy conclusions by ensuring that the study is carried out methodically and in an organized manner. In this study the researcher will use Single group Pre–Post

Test Longitudinal Survey Research Design.

- **Pre-Test:**

Participants: A group of B.Ed. students who are about to participate in a specialized Teacher Education Program.

➢ Assessment: before study to the Courses, participants' current techno- pedagogical skills and understanding of Personalised learning approaches are measured. This could be done using self-constructed tool, designed to assess their knowledge and skills. A longitudinal survey method will be utilized to track these variables over time.

- **Given structured Intervention:**

➢ The Pre-service Teachers participate in the Teacher Education Program, which includes both ICT-AI Courses that provide theoretical and practical knowledge and online internship that offers a practical exposure. Given structured Intervention aims to enhance their ability to integrate technology (specifically ICT and AI tools) and Personalised learning approaches into their future teaching practices.

➢ Components: The program consists of lectures, hands-on activities, online modules, and real-world application through internships.

- **Post-Test:**

Assessment: Upon completion of the course, the same group of participants is reassessed using the same measurement tools as the pre-test. This post-test will measure any changes in their techno-pedagogical skills and their ability to implement Personalised learning approaches in the classroom.

Comparison: The pre-test and post-test results will be compared to determine if the intervention (ICT-AI Courses and online internship) has led to improvements in the participants' skills and knowledge. Any observed changes or improvements can indicate the effectiveness of the program in enhancing techno-pedagogical competence and the integration of Personalised learning methods.

10.1 Sampling Method

In order to draw conclusions about the entire population, sampling methods are the strategies used to choose a subset (sample) from a larger population. Because it is frequently impractical or impossible to collect data from every member of a population, sampling techniques enable researchers to collect data

in a more economical and manageable manner while maintaining sample representativeness. In this study the researchers will use Purposive sampling method for this study and Random sampling technique will be used for the selection of the students.

10.2 Selection of the Sample

Selection of the sample is an integral part of every research project and its success depends upon the right selection of the sample. Good result can be expected from a good sample; hence great care should be taken in the selection of a sample. A researchers should select a suitable sample. In order to serve a useful purpose, sampling should be representative or unbiased. In In this study 100 Students from Dayalbagh Educational Institute of B.Ed. programme will be taken through Purposive Sampling Method.

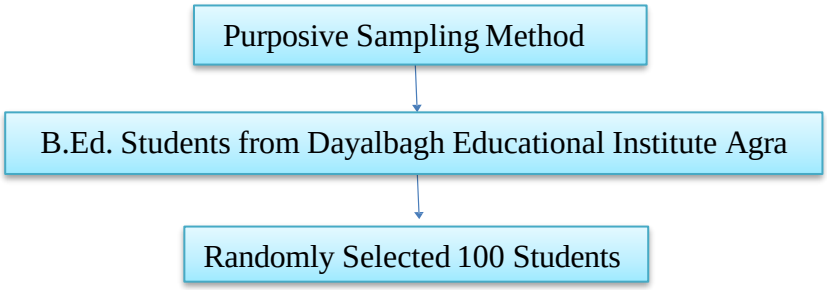

Figure 2 Sampling Selection

10.3 Measurement Tool

Measurement in research refers to the process of systematically assigning numbers or labels to characteristics or attributes of phenomena according to specific rules. It is a crucial part of research as it provides the data that researchers use to analyse, compare, and draw conclusions from their studies. Measurement enables researchers to quantify variables, observe patterns, and determine relationships between different factors. In this study the researcher could not find any related tool which is concerned accordingly so the researcher will prepare self- constructed tool.

In this research, the researcher will design and implement a self-constructed tool meant at evaluating the impact of different Courses on the development of techno-pedagogical skills and Personalised learning among newly admitted B.Ed. students. The study will be conducted over a series of semesters, with each course focusing on different aspects of technology integration in teaching and learning.

The process will begin with the newly admitted B.Ed. students enrolled in the first semester, who will

participate in a course title: Fundamentals of Artificial Intelligence in Education and another course titled "ICT for School and Teaching Learning Management." The self- constructed tool will be administered to assess the students' techno-pedagogical skills and Personalised learning outcomes as they progress through this course.

In the second semester, the researcher will again administer the same way to the same cohort of students enrolled in a course titled "Application of AI Tools." This will allow the researcher to examine any changes in the development of techno-pedagogical skills and Personalised learning in response to the new course content, which integrates artificial intelligence tools for teaching. The courses are in both theoretical and practical based course on the basis of these courses' students learning outcomes will be measured for techno-pedagogical skills and Personalised learning.

Finally, in the third semester, the researcher will repeat the process with students enrolled in a course titled "School Internship 3 Online Teaching." The self- constructed tool will be used once more to measure the students' growth in techno-pedagogical skills and Personalised learning as they engage with online teaching practices in an internship setting.

This study employs a longitudinal survey design, with the researcher collecting data at three different points over the course of the students' B.Ed. program. By comparing the results from each semester, the researcher will be able to track the impact of the different Courses on students' development in the key areas of techno-pedagogical skills and Personalised learning. Through this approach, the researcher aims to gain insights into the effectiveness of these Courses in fostering essential skills for modern teaching and learning environment

10.4 Statistical Technique

Statistical techniques are essential tools used to collect, analyse, interpret, and present data in a meaningful way. Whether in social sciences, business, healthcare, or engineering, statistical methods enable researchers and professionals to derive insights from raw data, make informed decisions, and identify patterns and relationships. The use of appropriate statistical techniques is fundamental in transforming qualitative and quantitative data into useful knowledge. These techniques help assess variability, test hypotheses, predict future outcomes, and understand the underlying structure of data, all of which are crucial for making evidence-based decisions. In this study the statistical techniques will be

used -

- Mean
- Standard deviation
- t- test

Mean

The mean is one of the most commonly used measures of central tendency in statistics. It provides the average value of a dataset and gives a sense of the "centre" of the data distribution.

Standard Deviation

The standard deviation measures the amount of variation or dispersion in a dataset. A low standard deviation means that the values tend to be close to the mean, whereas a high standard deviation indicates that the values are spread out over a wider range.

t- test

The t-test is a statistical test used to determine if there is a significant difference between the means of two groups. It helps to assess whether any observed differences are likely to have occurred by chance or if they represent a true difference between the groups.

10.5 Research Procedure

The plan or blueprint that describes the precise procedures and techniques a researcher will employ to carry out a study is known as the research procedure. Decisions regarding the research's methodology, data collection techniques, data analysis, and reporting are all included. The design aids in making sure the research is set up to produce significant and reliable findings.

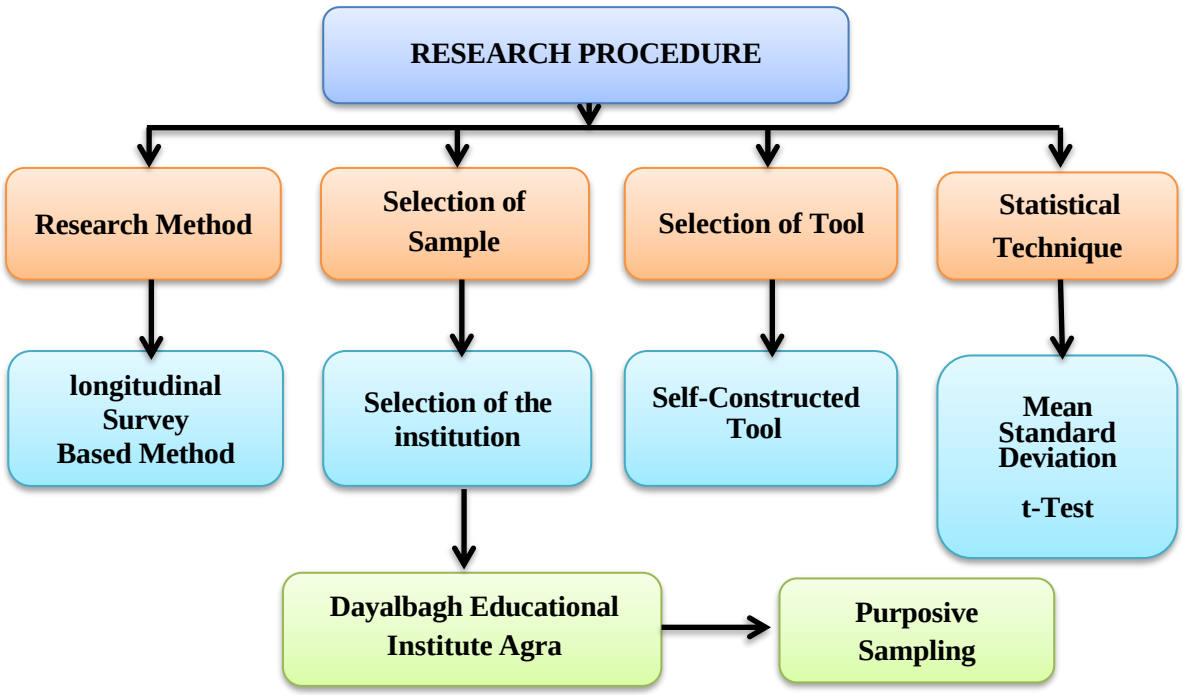

Figure 3 Research Procedure

11.0 Delimitation of the Study

- The study will focus specifically on a group of Pre-service Teachers enrolled in a teacher education program of Bachelor of Education.
- The study will be conducted at a specific educational institution Dayalbagh Educational Institute, Agra, UP.
- The research will examine only the impact of a specific intervention (ICT-AI based Courses and online internship program) on certain skills, such as techno-pedagogical skills and Personalised learning, among Pre-service Teachers.
- The study will involve a sample of a predefined number of participants 100 B.Ed. students to ensure a manageable scope and data collection process.

12.0 Educational Significance of Study

- Pre-service Teachers gain the ability to incorporate AI and ICT into their lessons, which improves student engagement and lesson delivery so that they can improve techno-pedagogical skills
- Teachers can create a more productive learning environment by customizing learning experiences to meet the needs of each individual student whit the help of AI- technologies so that the pre service

teachers could improve Personalised learning

- Pre-service Teachers improve their ability to teach in remote and hybrid environments by gaining hands-on experience with digital tools.
- Online internships support learner-centred strategies that foster students' independence and critical thinking in virtual learning environment.
- The experience equips Pre-service Teachers for the challenges of education in a world that is becoming more technologically advanced and digital.
- Student engagement and results are improved through the use of adaptive learning techniques and personalised feedback.
- Pre-service Teachers gain a solid foundation in the use of educational technology to improve the educational experiences of their students.
- The internship supports the development of teamwork and communication abilities in online learning environments. The confidence of Pre-service Teachers in utilizing digital tools and platforms is greatly increased.
- Teachers are encouraged to continuously improve their digital and pedagogical skills through online internship, which support lifelong learning

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